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ABSTRACT

This study focuses on the nature of educational development in the United States as determined by an analysis of the available literature. There is general agreement that educational development has not achieved the status now accorded to the general avocation of research by educators. This appears to be the result of a relatively short history and a lack of preciseness in the description of the developmental process. The recent institutionalization of the educational research and development process by Congress and the U. S. Office of Education through the establishment of the educational R&D centers and regional educational laboratories has resulted in a convergence of opinion on what constitutes educational development as well as a clarification of which organizations should be primarily responsible for the development function in education. Moreover, the pre-eminence of the Federal Government in specifying the direction of educational research and development through its funding of programs and projects indicates that political considerations are likely to continue to influence the growth and direction of educational development in the United States. The recommendation is made that managers of educational developmental programs adopt strategies which will support a mix of both small- and large-scale developmental projects. (Author)

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THE STATUS AND FUTURE PROSPECTS OF EDUCATIONAL DEVELOPMENT: A HISTORICAL TREATMENT

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John L. Wasik

Center for Occupational Education

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JOHN K. COSTER, DIRECTOR

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PREFACE

This report was begun as a status report of educational development as presently practiced in the United States. It was thought that a review of the educational research and development literature would provide a basis for deriving a picture of the present status of educational development in the U. S. Reviewing the writings on the theory and/or nature of educational development, however, made it apparent that little information was available on the present practices of developers of educational products and that much of the available information on the process of educational development was, at first reading, conflicting. It also became apparent to the writer that changes in the whole structure of educational development as currently practiced were distinctly possible under the changing priorities and support given educational research and development in general and development in particular. For these and other reasons, it was decided to expand the status report into a paper on the subject of educational development--what it was, what it is now, and what it may be in the future.

The Center wishes to acknowledge Dr. Wasik for his work in this area of "research on research." The Center also extends its appreciation to Dr. Joe R. Clary, Executive Director of the State Advisory Council on Vocational Education, and J. K. Dane of the Center staff for reviewing the manuscript prior to publication. The author and the Center wish to thank Mrs. Sue King for editing this paper, Mrs. Olive Maynard for typing the final copy, and the entire Center staff for contributions to the publication of this report.

John K. Coster
Director

SUMMARY

This study focuses on the nature of educational development in the United States as determined by an analysis of the available literature.

There is general agreement that educational development has not achieved the status now accorded to the general avocation of research by educators. This appears to be the result of a relatively short history and a lack of preciseness in the description of the development process. The recent institutionalization of the educational research and development process by Congress and the U. S. Office of Education through the establishment of the educational R&D centers and regional educational laboratories has resulted in a convergence of opinion on what constitutes educational development as well as a clarification of which organizations should be primarily responsible for the development function in education. Moreover, the pre-eminence of the federal government in specifying the direction of educational research and development through its funding of programs and projects indicates that political considerations are likely to continue to influence the growth and direction of educational development in the United States. The recommendation is made that managers of educational developmental programs adopt strategies which will support a mix of both small- and large-scale developmental projects.

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INTRODUCTION

The role of development in education was forced on the attention of the educational constituency by passage of the enabling amendments to the 1954 Cooperative Research Act in 1963 to establish the research and development centers program. Much of the initiation of support for educational R&D came from the feeling that directed programmatic methods utilized by industry would also prove to be successful in improving educational practices. Also highly visible at this time, the successes of the United States National Aeronautic and Space Administration program were thought to indicate that the creation of a center utilizing the talents of professionals from several academic disciplines would lead to the solution of significant educational problems. In 1964 the Task Force on Education, chaired by John Gardner, recommended the establishment of educational laboratories to carry out educational development and a variety of other tasks relating to the diffusion of research and innovation throughout the United States. These recommendations were implemented as Title IV of the Elementary and Secondary Education Act of 1965.

Thus, a network of institutions was in the process of being established in the middle 1960's with an assigned mission of conducting educational research and development. However, when one refers to educational R&D, he is more likely referring to research than to development. In speaking of the nature of educational development in late 1970, Schutz (1970) states that

> while there is a vague realization that it should be possible to translate available relevant knowledge into a form that permits improved educational practice, it is erroneous to assume that the means for doing this are presently clear [p. 39].

It would also seem to be unfair to determine the success of educational development in the five years or so that the U. S. Office of Education has supported educational development as some governmental study groups have attempted to do. However, it is appropriate to investigate the rationale which is being used to justify support for educational development. This paper will attempt to identify some of these bases through a review of development in the United States up to the present, a discussion of its present status in education and society, and some introspective guesses of future trends.

BACKGROUND OF EDUCATIONAL DEVELOPMENT IN THE UNITED STATES

Gideonse (1970) in his review of the status of educational research and development in the United States noted that a considerable amount of variation existed in the use of such terms as research, inquiry, and development by individuals responsible for educational R&D. He further noted that failures to make distinctions among research, development, experimentation, demonstration, and evaluation resulted in problems of assessing the effectiveness of some R&D programs. It is generally found that queries directed to educators about the activities comprising the R&D process result in a description of activities which fall under the domain of research and very few which are part of the process of development. In retrospect, this does not seem surprising if one notes that most formal programs for developing educational inquiry skills in persons may have provided an exposure to research methods, but it is highly unlikely that these same people would have been exposed to the systematic procedures utilized in educational development projects.[1] Thus, it is possible that many educators feel research is a much more important activity than is development because of the mistaken belief that only research uses systematic inquiry procedures. In view of the apparent widespread misconception of the nature of the R&D process, it would seem necessary to define development as used in educational R&D and to contrast this definition with terms such as applied research, development, and developmental research.

A review of the literature on educational development reveals two somewhat different stances on what comprises educational development. One view, as can be seen from the writings of Klausmeier (1968) and Cronback and Suppes (1969), is that educational development is considered to be essentially applied research. Klausmeier's perception has developed as a result of his experiences in managing the Wisconsin Research and Development Center for Cognitive Learning. He noted that clear-cut terminal points at which research ends and product development within a project begins cannot, in general, be established.

A similar view was put forward by Suppes and Cronback (1969) in their report written for the National Academy of Education: Research for Tomorrow's Schools; Descriptioned Inquiry for Education. In their view,

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[1] A course entitled Introduction to Educationary Inquiry is being developed under the auspices of the National Symposium of Professors of Educational Research to serve as an alternative to the traditional educational research methods course presented to graduate students in education. This course, which treats educational development as one of the approaches to conducting educational inquiry, is presently undergoing a nationwide field test.

the term research does not include all of the work which results in educational change. For this reason, the broader, more encompassing term "inquiry" was selected as more appropriate for the description of activities being conducted for the purpose of making lasting, massive changes in education.

They also felt that inquiry in education results in studies which have two different purposes: (1) conclusion-oriented and (2) decision-oriented. It is proposed that conclusion-oriented research allows for deviation from original goals if results from previous studies suggest to the investigator new directions in which to move.

According to Cronback and Suppes (1969), the purpose for conducting decision-oriented inquiry is to provide information to a decision-maker. Here, the investigator is not free to redirect his interest; in fact, he has an obligation (contract) to achieve the originally stated goals. Decision-oriented inquiry is then broken down further into types of studies conducted for a decision-maker; these are product development or the operation and/or maintenance of an educational system. Since this review is concerned with development, only the product development component will be described here. Developmental research is conceived by Cronback and Suppes as a systematic development-research process which includes the three steps of (1) collecting information to design a product, (2) testing the pilot version so as to identify and explain and to remediate product faults, and (3) appraising the final product. Development-based inquiry ends when the product goes into production. At this point it may become a concern for operational inquiry.

The two descriptions of the developmental process presented above include the integration of a research component into the development process. Cronback and Suppes feel that some research will be required in order to conduct product development in a systematic manner. It is also apparent that the research activities referred to in the two views of educational development are generally described as applied research. Klausmeier, in particular, notes that his definition of developmental research is the same as that used by others in describing applied research.[2] This combination of the activities of research and development within an R&D group would appear to describe the organizational mode found in industrial R&D groups. Thus, it may be reasonable to conclude that developmental research activities can be identified as either applied or development-based research. In a review of the distinction between types of R&D activities, Reagan (1967) concluded that writers use different bases in attempting to distinguish between applied and basic research, which leads to difficulties in categorizing research as either applied or basic. He suggested dropping the applied-basic distinction

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[2]The National Science Foundation defines applied research as "research carried out with practical applications in mind and may either be concerned with translating existing knowledge into such applications or creating new knowledge."

and distinguishing activities on the basis of whether they were research-oriented or development-oriented. He felt that this would result in a much smaller proportion of investigations which could not be categorized according to purpose. It seems to this reviewer that while applied research is required in the development of educational products, it is still important to establish development as a unique form of activity and to keep it separate from applied research. This is the type of distinction that is generally accepted by writers on the philosophy and rationale of educational R&D.

The next section presents alternate definitions of the term "development" which have been utilized by writers concerned with education. At the end of the section a synthesis of these definitions is attempted so as to provide a common referent for reading the remainder of the report.

Definitions of Development

The most widely quoted definition of educational development is the one established by the National Science Foundation for use in their surveys of scientific R&D. Development is described as a separate activity within the composite R&D process and has been defined by NSF as:

> The systematic use of scientific knowledge directed towards the production of useful materials, devices, systems, or methods, including design and development of prototypes and process [Perlman, 1963, p. 46].

The Bureau of Social Science Research based in Washington, D. C., carried out a national survey of school practices and attitudes that were related to educational research and development activities. For the purposes of their study, development was defined as:

> Producing, through careful design and engineering, materials, techniques, processes, and organizational formats for instruction which accomplish specific objectives [Bailey, 1969, p. 31].

As presently perceived by the Center for Occupational Education, development is defined as the invention of new solutions to perplexing problems in occupational education (Coster, 1970, p. 53). Development, this definition assumes, infers a set of specifications for a product so that a development project is oriented toward the goal of meeting the specifications.

The developmental process was described by Henrik D. Gideonse, Director of Program Planning and Evaluation, National Center for Educational Research and Development of the U. S. Office of Education, to be the production of materials, techniques, processes, hardware, and organizational formats for instruction which accomplish certain objectives, specified in advance, which are constructed to be part of the

broader goals of instruction or education (1970). According to this perception, development is distinguished from research in that the outcome is known or established at the beginning.

Guba (1968), in another attempt to define development, focused on the activities associated with the identification of operating problems and the formulation of solutions to these problems. In his view, development would include the functions of production, engineering, packaging, and testing a proposed problem solution or invention.

Roger E. Levien (1971), director of the plan for establishing the National Institute of Education, felt that development would have an important role to play in the program of NIE. He defined development as the creative process of inventing new products, systems, or procedures. Developmental activity was categorized according to function: operations development or product development. Operations development was described as including activities leading to solutions for managerial problems, while product development referred to the invention of products for instruction or other educational uses. It should be noted that Levien's distinction between types of developmental activities is the same as the distinction presented by Cronback and Suppes for distinguishing between types of decision-oriented inquiry.

Gallagher (1970) introduced the concept of accountability in educational development. He suggested that developmental activities are directed toward the development of products or procedures which must be useful--useful in the sense that they are defined in terms of some consumer group.

It appears pertinent here to attempt to make a distinction between development and developmental activities. Gideonse (1970) has described developmental activities to be the production of materials, techniques, processes, hardware, and organizational formats for instruction. According to his definition, a teacher's preparation for classes the next day would include activities which can be described as developmental activities or developmental research by the degree to which systematic design and production procedures are utilized. According to this definition, developmental activities which would utilize systematic development procedures would be referred to as developmental research, while daily class preparation which is developmental in nature would not be called developmental research.

Although the above presentation includes only a small sampling of definitions and/or descriptions of development, developmental activities, or developmental research, it is obvious that all of these statements include the need for utilizing systematic procedures in the development process. Also, development is identified as a distinct type of activity which can be distinguished from research and/or demonstration activities.

It is this writer's contention that development in education will require applied research activities to overcome unforeseen problems and/or to develop some component foreseen or not at the beginning of the

product development phase. It does not, however, require that research and development capabilities be contained within the same group as in part of a large R&D effort. The best presentation of this relationship, in this reviewer's opinion, is expressed visually by an output model developed by Gideonse (1968) to portray the relationships among research, development, and operations. He discusses several "walk-throughs" of the model to indicate how developmental activities can require the knowledge which can be generated by the initiation of an applied research study.

At this point, it may be helpful to present an example of a concept that has proceeded through all of the stages of an educational R&D process. A good example of an educational product which evolved as a function of the developmental process as accepted above for the purposes of this paper is the group mental ability test.

The concept of individual differences in mental ability appears to have been a logical deduction of the theory of evolution as stated by Darwin which suggested individuals differed in their ability to "survive." Galton utilized this rationale as a basis for developing mental ability tests for use in the selection of Civil Service employees. Later, Binet developed an individually administered instrument for use in identifying mentally defectives from a population for non-learners in Paris schools. It is likely that the acceptance of the idea of a measured mental ability led to an increasing interest in the development of the first, well regarded, standardized test for measurement of intelligence, the Army Alpha, in 1916. In fact, one of the best examples of the developmental process in action today is the process test publishers use to construct (develop) a test.

A substantial amount of research on properties of tests and test scores has resulted in a particular body of knowledge which is referred to as the theory of testing. This knowledge can be used to construct a test with certain psychometric characteristics. Using banked data on test item difficulty and discrimination indices obtained from the results of previous tests, the desired test specifications can be read into a computer program which will take care to follow desirable test item arrangement practices in the production of the final test form which has the desired psychometric characteristics. Studies conducted by the Educational Testing Service have demonstrated use of such product development procedures to be very successful in attaining the desired test specifications. It is interesting to note that it took 50 years from the original research into the process of mental ability measurement to the actual implementation of the first standardized test, and the further revision of these ideas into developing a test with specific psychometric properties required only another 20 years. Thus, further development of a product required less time than the time to accomplish the original task. This phenomenon is well documented and will be discussed later in the paper.

A History of Educational Development in the United States

The definition of development accepted for use in this paper will allow the inclusion of systematic invention, production, and refinement procedures as well as instructional products. Utilizing such a definition, a review of educational development in the United States should begin with the attempts in the 1840's to develop an elementary school curriculum which was based upon the principles of object-teaching and warm attention to the child. While this attempt to construct a curriculem did not use formal evaluation procedures or scientific inquiry as the basis for making changes in the instructional program, it was, nevertheless, a movement toward using rational methods for introducing changes in the school as a means of improving education.

In the 1890's the first attempts began to use the scientific method to raise questions about educational practice and to use results from experimental studies to make changes in instructional and administrative procedures. Examples of the use of conclusions obtained from studies of learning can be noted from the work of George Bobbitt, who revised curricula on the basis of systematic observations of contemporary society, and the work of George Strayer in school administration policy formulation which was based upon a quantitative analysis of school performance.

Another landmark event in the history of educational development in the United States was the establishment of the Laboratory School at the University of Chicago by John Dewey in 1896. A review of the statements made by Dewey on the purposes of establishing the Laboratory School would suggest that he envisioned a setting in which certain hypotheses about learning could be tested and practical instructional techniques could be developed. This process of development and dissemination was perceived as being a way to introduce innovation in education practices at the time. In retrospect, it appears that Dewey saw the purpose of the Laboratory School to be the same as that of an educational R&D center or a regional educational laboratory in operation today. Dewey did not follow through on the use of systematic procedures to produce materials, practices, and products as he first set out to do. He was not required to do this because his ideas were accepted enthusiastically without scientifically derived proof. While he was not required to provide support for the validity of his contentions, he did provide the first description of the manner in which true educational R&D should be carried out.[3] In contrast, Robert L. Thorndike's suggestions for teaching specific academic subjects were in opposition to the established practices of the day; thus, he had to present proof of his theories of learning. That these claims were later accepted by individuals responsible for producing

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[3]The same criticism of the failure of laboratory schools to lead the way in educational innovation and demonstration was voiced by Brickell in his review of the dynamics of instructional change in the elementary and secondary schools of New York in 1961.

instructional materials has been documented by Cronback and Suppes in their contrast of the writing of textbooks prior to and after the publication of Thorndike's research. In this case, only the failure to use the development field test--revision recycling procedures to modify materials in order to ensure the attainment of the development objectives--distinguishes these early attempts at instructional materials development from those being used today.

It should be noted that the production of textbooks follows essentially what would be referred to as a developmental activities approach. This is particularly the case in the development of textbooks for elementary and secondary students. In many cases, these instructional materials have been subjected to field testing in an attempt to improve the materials and to ensure that performance specifications are being met. Examples of this process are provided by the curriculum development efforts of the last 15 years, e.g., PSSC (Physics), SMSC (Mathematics), BSSC (Biology), etc. In these projects teams of writers used summers to rewrite specific curriculum materials whose use in selected schools had not accomplished to the desired degree the objectives originally specified.

In contrast, at the college level, apparently very little is done to field test text materials outside the usual tryout with the instructor teaching a course using his notes. Instead, the reliance is upon selecting a person with professional stature to ensure an appropriate set of content and sequence objectives. Some recycling generally occurs only when the author decides to revise the text; at this time some comments from users of the text may be considered in materials revision.

The next milestone in this attempt to provide an analysis of the growth of educational development would seem to be the recognition by Congress of the need for organized educational development. In 1954, the curriculum reform movement already referred to above had its start with the allocation of money from the National Science Foundation to improve course content, while at the same time the Cooperative Research Act was passed by Congress to allow colleges, universities, and state educational agencies to enter into agreement to conduct surveys, research, and demonstrations in the field of education.

This appears to be the first attempt of the federal government to provide support for projects which could be described as developmental. Until this time most of the support for educational R&D was provided by philanthropic organizations (for research) and by private industry (for materials development). In fact, it seems fair to say that the use of federal funds to systematically develop educational products was a truly revolutionary concept.

Authorization for the National Science Foundation to provide support for curriculum development was first passed by Congress for fiscal year 1954. Beginning with a new physics curriculum for the secondary level to be managed by the Physical Sciences Study Committee in

1956, the National Science Foundation supported additional program development in the sciences and mathematics for elementary, secondary, and college levels The most recent emphasis for program development has been in the use of computers in education and instrucational programs.

Also in 1954, as noted before, the 83rd Congress passed the Cooperative Research Act which authorized the U. S. Office of Education to enter into contracts with institutions of higher education and state educational agencies for the conduct of research, surveys, and demonstrations in education. While this act provided for activities not referred to as developmental, per se, the decision of the government to enter into support of activities which can be described as of an inquiry nature provided a basis for the later amendment to the act to provide for support of activities which were clearly developmental in intent. For instance, in 1961-62 new authorization under the Cooperative Research Act provided monies for developmental activities such as curriculum improvment in English, language arts, and the social sciences

Initial support for the program for research and development centers was obtained under the Vocational Education Act of 1963 for two vocational education research and development centers and in 1964 from the Cooperative Research Act for nine educational research and development centers to work on problems of educational concern. The spring of 1965 saw the U. S. Congress make major revisions in the Cooperative Research Act in response to criticisms of the fragmented nature of educational inquiry sponsored by the federal government. These amendments permitted the establishment of educational laboratories--later referred to as regional educational laboratories--for the purpose of carrying out educational development and a number of other tasks related to the diffusion of R&D-based innovations throughout the educational system of the United States.

Other educational developmental activities have also been supported by the federal government during this period, including: (1) the uses of new media and of the study of foreign languages authorized by the National Defense Education Act of 1958 (NDEA); (2) the development of programs to support research, research training, surveys, demonstrations, related dissemination activities directed to the education of handicapped children, and facility and equipment expenditures supported under Titles IX and X of the Mental Retardation Facilities and Community Mental Health Centers Construction Act of 1963; and (3) research, demonstration, and dissemination projects related to the improvement of libraries and/or the improvement of library personnel training supported under Title II-B of the Higher Education Act of 1965.

While the educational R&D centers and regional laboratories have been in operation for five years at most, it is again heard that a crisis of confidence in educational research exists. As noted by James J. Gallagher and David Krathwohl, members of Congress, the Bureau of the Budget, the planning bureaus of HEW, and the President's Science Advisory Committee, among others, have been critical of the research program that has developed. It is stated by Roger E. Levien (1971, p. 6), the director

of the study conducted to develop the initial plan for NIE, that "the reputation of educational R&D has been relatively low; individuals of competence (on the average) found in industrial or health R&D have not been attracted to work on problems of education." These were exactly the same kinds of concerns that were voiced at the time the research and development program under the then-existing provision of the Cooperative Research Act was being implemented. As noted in the 1969 NCERD status report on Educational Research and Development in the United States, the President's task force on education, chaired by John Gardner, stated that prior R&D efforts were small and generally not coordinated or cumulative (Gideonse, 1969). Further, the results of the research were not being picked up by educational agencies with responsibility for instruction. A final criticism was that a failure to include researchers from other disciplines resulted in a rather parochial view of what educational R&D should be and the procedures that could accomplish these ends. On the other hand, the final comment of Levien's--namely, that support was not large enough nor stable enough--is one complaint that was not expected when the R&D center and lab program was started. As noted in the NCERD status report, appropriations were substantially below the amounts authorized under the enabling legislation. When this fact is considered, along with the observation that education spends less than 0.3% of operational expenditures in education (Levien, 1971, p. 5), it is obvious that a major reason why educational R&D has not had a bigger impact on the improvement of education is the limited resources being applied.

Enabling legislation for the purpose of setting up a National Institute for Education along the same lines as the National Institutes for Health and the National Science Foundation was passed during 1972. Backers of the concept of NIE felt that the only way the necessary resources to make substantial changes in education can be attracted is through the establishment of an organization with enough prestige to attract a substantial long-range commitment from the Congress. Further, it is felt that only such an institution would not have to change priorities so as to accommodate programs every time a new Commissioner of Education and/or President was installed in office.

Models for Educational Research and Development

The discussion of the history of educational development in the United States in the previous section suggested that support of development was a recognition by members of Congress of the responsibility of the federal government for making a positive and lasting change in education. First, the enactment of the Cooperative Research Act in 1954, under the urging of then Commissioner of Education, Samuel Brownell, implicitly suggested that Congress and administrators at the Office of Education felt research on significant educational problems would be conducted upon the awarding of a grant or contract from the Office of Education and that the results of those research projects would then be picked up by the organizations which would find these research findings to be helpful in solving a particular educational problem. This did not

turn out to be the case. It is quite apparent that one reason these results were not picked up was because there was no follow-through. In the typical case, the researcher, once he made his report to Washington, D. C., and reported the results to professional colleagues, was finished with that particular project. On the other hand, the organizations which would have some use for the output from the research project did not have the resources, in terms of either time or skilled manpower, to do the development work that was required. This was recognized by individuals with administrative responsibility at the Office of Education, and, thus, the passage of the National Defense Education Act authorized demonstration and research projects so that local and/or regional educational agencies could obtain money to develop and demonstrate products based on findings from educational research projects. When a local education agency obtained a contract to do this work, teachers would likely be used to provide the manpower for this. In addition to lack of experience in product development procedures on the part of personnel doing the work, these persons would likely return to the classroom once the particular project was finished. Thus, there was no way of establishing and maintaining a cadre of individuals working on a full-time basis to conduct the work of development, demonstration, and diffusion which is necessary to bring the results of the research project into the classroom. When private industry and the universities are included, the record is only slightly better. As noted previously, the test publishers and groups concerned with curriculum development used somewhat the same steps in the attainment of a final product, but they often used only informal evaluation procedures to obtain information required for materials revision. Further, performance specifications are generally lacking for the prospective users of the materials. However, those innovative procedures first followed in the 1950's did provide a basis for the later development of instructional products by highly systematic and specified procedures as described later in this paper.

While the above approaches were indirect attempts to get results of research studies into a form that could be used in the classroom, it was recognized during the early 1960's that a new organization was needed to formally apply research study outcomes. It seems apparent that this thinking in the federal government resulted in the institutionalization of the R&D process with Office of Education support at about this time. The first educational research and development center was authorized in fiscal 1964 under the provisions of the Cooperative Research Act.

The concept of educational laboratories had its beginning in the 1964 report of the Task Force on Education chaired by John F. Gardner, who later became Secreatry of Health, Education, and Welfare under the Johnson administration.

Legislation in the form of Title IV of the Elementary and Secondary Education Act of 1965 provided for the implementation of the recommendations of the Gardner task force. Suggestions of possible models for the R&D centers and regional laboratories to emulate centered upon the agricultural experimentation station, medical research, and space

industries (Bloom, 1968, p. 181; Bailey, 1970, p. 5; Chase, 1968, p. 4; and Schmidtlein, 1970, p. 18). Former Commissioner of Education Francis Keppel spoke in support of the experiment station approach before the Senate Subcommittee on Education: "I think the whole history of the United States in the agricultural experiment stations shows how marvelously successful this approach has been [Bailey, 1970, p. 6]."

However, the earliest reference to educational research and development that this reviewer could find was made in a panel gathered together by Robert Glaser at the University of Pittsburgh in January, 1960, and sponsored by the Office of Naval Research. As Dr. Glaser noted in his preface to the report of this conference:

> A good portion of the work performed by the individuals involved in this effort has been devoted to research and development in problems of training and the underlying phenomena of learning that are involved. The results of this endeavor are obviously relevant not only to specialized military problems, but to civilian education and to the science of learning. A unique aspect of this activity is the fact that an increasing number of persons trained in experimental psychology have been turning their attention to the problems of training and education. In the light of the expressed concern of the United States with education, this meeting of science and education is of great interest - The purpose of this volume is to present a representative account of the training research that has been carried out and to examine its implications for psychological research and for training and education [1965, p. v].

Thomas F. Gilbert, one of the panelists at the meeting, presented a chapter for a book entitled "A Structure for a Coordinated Research and Development Center," in which he described a research and development center utilizing the methodology generally referred to as the experimental analysis of behavior.[4] His model provided for the activities of basic and applied research and development to which he referred as exploratory research, fundamental development, and specific development, respectively. He stated that his view of the R&D process had been strongly influenced by the methodology utilized in conducting military service training research projects of the type conducted by the Human Resources Research Office (HUMRRO) during the 1950's. He also indicated that this type of research and development process is much closer in genealogy to R&D as practiced in industry than is the agricultural experiment station model.

Following the premise that institutions which receive the greatest amount of support from a granting agency are perceived as having a successful program in operation, a review was made of the organization and operational procedure for the two R&D centers with the greatest amount of support in 1969. The Wisconsin Research and Development Center

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[4]For an excellent discussion of this approach to educational inquiry, see Schutz (undated).

for Cognitive Learning at the University of Wisconsin and the Learning Research and Development Center at the University of Pittsburgh were found to have had the highest levels of support from the Office of Education in 1969. It is interesting to note the high degree of similarity between the programs of the two centers. Both centers indicate they do both basic research and developmental work. Both organizations test instructional products and procedures in schools operated by the community. Both centers encourage their researchers to be involved in the product development end as well as the research aspect of educational R&D. While the program areas of the two centers are somewhat different, it is interesting to observe that both are conducting research on the same problems (i.e., research on variables related to learning and instruction, product development, and educational environment). One difference is apparent to this reviewer. The development of the multiunit at the University of Wisconsin has resulted in a number of different situations where research can be conducted or products can be developed similar to the way that the agricultural research stations are used by State Agricultural Extension personnel. The Pittsburgh Center, in contrast, seems to use the approach suggested by Gilbert as a model for an educational R&D center whereby products are developed under laboratory conditions to product specifications and then utilized in an available school to test the effectiveness of the product in obtaining results noted in the laboratory.

In summary, it would seem that the R&D process as practiced by the above centers seems to differ somewhat from the R&D process generally envisioned by the public in general. It seems that their perception of the R&D process runs from the establishment of one research finding by one or more scientists (e.g., programmed instruction) to the later development of the idea into a usable product (e.g., the development of individualized instructional program, i.e., IPI) by another group of individuals in product development. In the educational R&D setup, it seems that there is very little theory available upon which to base development--a notable exception would be the theories of reinforcement as postulated by Skinner. Thus, much of the educational work being done now could be considered as technology where certain ideas which have been around are changed so as to lead to a new instructional mode, much in the same manner that automobiles are given yearly facelifts which do not result in any observable increase in performance. It remains to be seen whether the establishment of a National Institute of Education will result in a markedly different R&D approach to solution of educational problems than the paths followed by the Wisconsin and Pittsburgh R&D centers.

EDUCATIONAL DEVELOPMENT AS A PROCESS

Prior to the mid-1960's when the federal government began to assume the major role in funding educational R&D efforts, most of the theorizing about educational inquiry was concerned with established models of educational research. With the impetus provided by the institutionalization of educational R&D efforts through the establishment of the R&D centers and regional educational laboratories, spokesmen of the educational community began to develop a rational basis for the results of research to develop an instructional product which could then be put into operation in an educational system.

Among the earliest presentations of the R&D process were the models suggested by military training research which provided for the sequential activities of exploratory research, fundamental development, and specific development (Gilbert, 1962). Hilgard in 1964 posited a six-step model describing the process required to move from research or learning theory to the development of an instructional product. In this model it is assumed that progress is made serially along a continuum which results in improved practice.

Guba and Clark (1965) developed a model which provided a framework for analysis of the roles for changing educational systems including a linear arrangement of the processes of research, development, dissemination, and adoption. A later revision of the model provided a taxonomic classification of activities within the four stages of the model (Guba, 1968). These steps are presented in Figure 1. Since this paper is concerned with educational development, the discussion will be

Guba	Schutz
Depict	Formulation
Invent	Prototype
Fabricate	Component
Test	Product
	Installation
	Program

Figure 1. Comparison of Steps Hypothesized to Comprise Developmental Process

Sources: Guba (1969) and Schutz (1970).

limited to the process of educational development. Since the original role perceived for the regional educational laboratories was to serve as a means of getting new knowledge in the form of products in use by the schools, they have been concerned with specifying the types of activities which comprise the process of development. One of the most comprehensive statements on the process of educational development has been developed by the Southwest Regional Laboratory for Educational Research and Development (Schutz, 1970). (See Figure 1.) Before a discussion of the relationships of the Guba-Clark and SWRL models, a discussion will be presented that relates to criticism of these types of models. One of the criticisms made of the models being proposed for use in the United States for educational R&D is that the model operates according to a static linear form.[5] This criticism seems to refer to a lack of explicitness and not to the inability of the model to provide for dynamic interrelationships among the component steps of the educational development process. For example, the NSF-sponsored curriculum development projects of the late 1950's utilized a feedback between product development and tryouts in the class, which indicates that such a feedback loop could be incorporated very simply into all of the models presented in this section.

A second criticism is made in that models of the type presented by Gilbert and Hilgard assume that the development only follows after the results of basic research are attained. The results of "Project Hindsight" to be reported on more extensively later indicate the fallacy of such an assumption. Finally, it should be noted that this does not invalidate these models as convenient representations of the R&D process, since the portrayal of steps in a linearly directed fashion does not preclude the initiation of the R&D process at some point other than the basic research step. Indeed, the Guba-Clark model of change, which includes R&D as a segment, and the SWRL instructional products model state that development does not necessarily follow after some basic research results.

The Guba-Clark and the SWRL models seem to be representative of the types of models describing the development process; these models also denote activities which are fairly well specified. Thus, a comparison of the two models will be made in order to establish a consensus of what comprises the developmental process.

Comparison of the Guba-Clark and SWRL Models of Development

A contrast of the steps defined by these two models shows the greatest amount of disagreement in what is the beginning and ending points of the developmental process. Guba and Clark, for example, feel that the recognition of a problem for which a product must be developed

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[5]See the report made on educational R&D made by the Organization of Economic Cooperation and Development.

initiates the development process. In contrast, the SWRL model assumes that a problem has already been identified and that the developer's first step is to formulate strategies for alleviating the identified problem. According to the Guba and Clark formulation, these activities will occur in the invention stage. The SWRL prototype and component stages seem to include activities subsumed under the invention and fabrication steps described by Guba and Clark. Guba and Clark's testing stage and the SWRL product step seem to describe essentially the same types of activities, namely that of systematically trying out the product to see if performance specification levels are attained. This is the point at which the recycling aspect of the dynamic process model is introduced. The last two stages of the SWRL process of development seem to describe the activities of installation and institutionalization which are subsumed under the adoption stage in the Guba and Clark formulation. However, the overlap of activities from the SWRL model to the Guba-Clark model may be explainable in terms of the function of the two models.

The SWRL model describes activities which have developed through participation as a regional educational laboratory. The original conception of the regional educational laboratory as stated in the Gardner task force report of 1964 envisioned an agency which would take products and get them into the educational system. This role evolved later into one of developing usable educational products which would then be installed in educational systems. In fact, the description of the R&D role of the network of regional educational laboratories has been described as "little R and big D." For this reason, it is possible that the activities subsumed under the SWRL product development model began with a step that is obviously developmental--that of formulating strategies--and ended with an adoption-type process. Guba and Clark, in contrast, were providing a generalized model which could describe the R&D process in the context of processes of use in implementing change in education. Thus, they generally perceive the stages of development and adoption to be generically different and to require separate stages in the R&D process.

There seems to be substantial agreement on what activities are required in the developmental process, notwithstanding the differential perceptions of what is the beginning and ending process. While the SWRL model seems to suggest that the identification of a problem and the needs analysis will not come from the developmental team personnel, there is no reason why a special advisory group could not operate to provide input to the developmental team on what types of products will likely have immediate high utility in an educational system. Thus, in this sense, the models are not inconsistent. It is proposed here that the manager of an educational product development team can be perceived as operating much in the same fashion as his industrial counterpart who receives a contract to do a management study of an organization or a fee to design an industrial building. If one assumes the above then the first developmental activity would begin with the SWRL stage of formulation or the Guba-Clerk model of invention.

In contrast, it seems that the last two activities in the SWRL model might be better carried out by an agency that may be organizationally different or at least separate within the same organization. In fact, it has been noted that some of the knowledge obtained as a result of research studies begins to be applied in general only after it has been inculcated in a textbook and presented within formal instructional arrangements (Carter 1968). Thus, it would seem appropriate to establish centers where these new products could be demonstrated at institutions with responsibility for training instructional and/or administrative specialists. This approach would require that persons with competence in the use of such procedures be in residence at these proposed demonstration centers.

In summary, this paper considers the process of development to comprise the activities of Formulation, Prototype, Component, and Product as described by the SWRL model. It is further proposed that the serial arrangement suggested by these steps can be modified by the inclusion of entry points and feedback loops throughout the four stages.

THE FUTURE OF EDUCATIONAL DEVELOPMENT

In predicting the future, one has to have some basis for making forecasts. When one considers that the future of educational development will be a function of decisions made by the federal bureaucracy subject to the constantly changing political influences, the job of forecasting becomes precarious. The following is hesitantly presented as a description of the present situation with regard to educational R&D support and a rationale for future directions that could be followed by those administrators responsible for managing educational development.

Present Support for Educational Development Programs

Federal support of educational research and development at the present time does not lead to confidence about the future funding of educational R&D programs. A number of pertinent remarks on why the federal government is not supporting educational R&D efforts as strongly in the 1970's as they were in the 1960's were presented by Dr. James Gallagher, present director of the Frank Porter Graham Child Development Center and recent former Deputy Commissioner for Planning, Research, and Evaluation, USOE, during a presentation to the 1970 American Psychological Association Convention in Miami Beach, Florida. He noted first that Congress essentially felt that little or no improvement in instruction had resulted from the huge outlay of funds for educational R&D in the 1960's. This negative attitude was assumed to be the cause of the recent actions of Congress (in 1970) to override a presidential veto of an "aid to education" bill which gave more funds than requested for educational activities in general but less than requested amounts for the support of educational research and development activities. Since the federal government is the main source of R&D funds in the educational area, it is likely that the aforementioned negative attitude of Congress will not likely lead to increases in activities of these types in the near future. It further follows that since the proponents of the National Institute of Education point out that the research and development proportion of the total expenditures of monies spent for education is among the lowest of the major industries (i.e., steel, chemicals, agriculture, etc.), educational R&D is even less likely to have an impact on education if its funds are kept at the same level or reduced.

Dr. Gallagher noted that a second constraint on the funding of educational development projects results from the cost differential between research and development. Research activity has often been described as a personal undertaking in which a relatively small investment in manpower and resources can result in major findings. Developmental activities, in contrast, require a relatively large personnel, which means a much more substantial outlay of funds. Gallagher (1970,

p. 28) estimated that five to ten times the amount of funds spent on a typical research project is required to support educational developmental projects.

A third factor which seems to bear upon the effects educational development will have on education is related to the time lag between a new finding and the application of this finding to solve some problem or to improve the educational process. Two recent reports which document the results of military and commercial and industrial-based product development provide an insight into the actual operation of the R&D process.

The first study, Project Hindsight, was conducted by the Department of Defense in order to determine what influences its support of basic research and development contributed to the development of new weapons systems and the value which could be placed on the improvement resulting from these developments (Sherwin and Isenson, 1967). Twenty different systems were studied in order to determine the various events or specific technological developments which allowed the design and production of the new weapons systems. An interview was then conducted with those responsible for the development to ascertain the scientific and/or technical origin and the environment in which this development was perfected.

Three conclusions resulted from the analysis of the collected data. First of all, it was found that nine percent of these events were science events while 91 percent were classified as technology events. In other words, the development of weapons systems benefited much more from technological studies and applications than from pure science itself. The authors conclude that

> however important science may be, we suspect its primary impact may be brought to bear not so much through the recent, random scraps of new knowledge, as it is through the organized 'packed-down' thoroughly understood and carefully taught old science [p. 1576].

A second finding was that 75 percent of the identified technological events were directly motivated and supported by the primary funding agency, the Department of Defense.

Thirdly, it was found from a systematic analysis of the distribution, time lags from the accomplishment of technological advances to initiation ranged from 20 years before to 10 years after, a range of 30 years.

While most of the events occurred prior to the initiation of the project to develop a particular weapons system, i.e., on the average of five years before, there were many that occurred after the project starting date. The time lags for discovery of an event and its application also distinguished between science and technological events; nine years for science events and five years for technological events. Thus,

it seems apparent that a considerable lag exists between the time at which the knowledge or a technique is developed and the time it is applied. Further, even though all the technology may not be available at the time a particular system is started, in general, it appears that the development of these component technological events is accomplished while the project is underway.

The second study which provided information on the time required in the R&D process was provided by the report of the TRACES project (1967). The purpose of this project was to trace the application of knowledge from the discovery of new knowledge which first made possible the development product to the actual process of utilizing this and other knowledge to turn out a usable product. The developmental sequence leading to the commercial production of magnetic finites, video tape recorders, oral contraceptives, electron microscopes, and matrix isolation was studied for similarities of R&D process. While many of the basic research findings required for the development of these products could be traced back some 50 years, much of the applied research required to market the product came near the end of the development sequence. Thus, even a product with such obvious applications as the video tape recorder required nine years between the time it was considered to be technically possible and the time it first appeared as a usable product.

There appear to be four implications of the conclusions derived from the final reports of both Project Hindsight and the TRACES project: (1) basic research does not lead to direct use of its knowledge in a product available for use by consumers and industry; (2) solution of problems should be attempted through the use of available technology rather than waiting for basic research to provide the requisite knowledge; (3) solutions to problems in the form of developed technology are more likely to be attained by personnel with expertise about that particular problem area and not by developments from other areas; and (4) a minimum of five and a median of ten years was the amount of time required between the actual initiation of developmental work and manufacture of the product in its final form.

These implications seem to focus attention on some fallacies in the original attempts to promote educational R&D and its present effectiveness as viewed by members of Congress and the federal establishment. If, as suggested by the Project Hindsight report, expertise in the area in which development is being undertaken is most effective, then the original model of an inter-disciplinary mix of personnel for conducting eductional R&D seems inappropriate, particularly for development. Further, the time lag of information on which "new knowledge" was based when it was applied suggests that it is unreasonable to expect institutions such as educational R&D centers and regional educational laboratories which have been in existence for less than ten years to have much effect on educational practices. The very real lack of educational theory must also be considered a prime reason for lack of progress in institutional change in the educational establishment.

When one takes into account the fact that federal sources provide most of the money required for educational development and that federal support of educational development is rather negatively viewed at the present time, it would seem logical to conclude that educational development is not likely to overcome or even make substantial progress in meeting educational needs. Indeed, the elimination of five regional educational laboratories during 1969 and four more during 1970 indicates that the base for educational development is shrinking.

Gallagher, in his Miami Beach speech, said that any educational problem being attacked must be given a three-to-five-year period of time with a fixed budget in order to accomplish what it set out to do. This policy supports projects at the budgeted level with the "understanding that it [the project] would not be tampered with except under the direct consequences" (1971, p. 28). Later, Gallagher noted the existence of the Targeted Development and Related Research Program of the Office of Education to put set percentages of available resources up to 50 - 60% into development and related research for clearly stated specific objectives. As a matter of history, this concept of providing program support by priority was, in effect, shelved less than six months after Dr. Gallagher made his speech.

Presently, there is an attempt to protect projects from arbitrary changes through the passage of enabling legislation to set up the National Institute of Education. The existence of NIE is supposed to ensure that certain projects will be protected. While this attempt to ensure continuity of R&D efforts in education appears reasonable, it is also obvious that recent cuts in the support of other national institutes suggests that the National Institute of Education is not likely to be immune from program modification as a function of budgetary changes.

A Viable Future Strategy for Maintaining Support of Educational Development

In the review of educational research and development policy sponsored by the Organization of Economic Cooperation and Development, OECD personnel expressed great excitement and interest in the research organizations that were being supported in the United States, but they were surprised that so few explicit statements of national or overall goals of educational R&D had been made in the United States. The Targeted Research and Development Plan was one attempt to set up a priority listing of national goals, the proposed plan NIE (Levien, 1971) provides another statement of objectives, and associated programs provide another. However, unless the educational R&D establishment is viewed in a more favorable light than that indicated by recent comments of the members of Congress, it is not likely to get sufficient support for continuing to develop and build an institution or network of institutions that will be capable of providing solutions to educational problems when its constituency becomes concerned. A point in evidence is the present interest shown by the public toward accountability as represented by the publishing of local achievement test score performance by school systems.

To ensure that public (i.e., federal) support is maintained for the benefit of educational development, it seems necessary to devote a certain amount of funds to the development of educational products which will require only a relatively short developmental period. In this way, funding variations should have a less debilitating effect on development. One way that seems to be ideally suited to the development of educational products within a relatively short time span is the eolithic approach. Schutz (1970) cites a description of the eolithic approach:

> An eolith is literally a piece of junk remaining from the Stone Age . . . stones picked up and used by man and even fashioned a little for his use! The important matter in this definition is that eoliths were picked up already, accidentally adapted to some end, and more importantly, strongly suggestive of the end . . . the fashioner of eoliths . . . must have a continually open mind about materials and he must be very adaptable in the matter of ends of what he wants. If the eolith defines the use it first suggested, then, perhaps, there is another use equally interesting and worthy [Hawkins, p. 166].

Schutz further comments that the eolithic approach seems to be ideally suited to education, "where ultimate objectives are seldom very clear and where the possible options are qualitatively diverse and heterogeneous" (p. 58). It can be seen that the process of altering slightly a completed educational system was one of the invention modes presented by Guba (1968) in his discussion of the developmental process.

Taking into account the above information, it seems reasonable that an optimization of educational development policy would ensure that a sizable proportion of funds available go toward eolithic-based projects. It is a political reality that one is not going to get support if one is not producing. Since the time lag between the initiation of a project for product development and its completion is roughly ten years on the average, a responsible program manager should be looking for ways to ensure a continuous flow of educational products which have some beneficial effect on learning and which will indicate to the disburser of funds (i.e., Congress, HEW, Office of Budget and Management, the President) that educational development is paying its way. It seems reasonable that the adoption of such a strategy will be politically viable and should ensure that funds will be available to the program manager for a mix of long- and short-term projects which will allow the organization to pursue its primary function of promoting change as a means of improving education.

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